EFFECTIVENESS OF TYRE CHIPS AS ALTERNATIVE MATERIAL IN GABION WALL TO ENSURE SLOPE STABILITY

MOHAMMAD AMIRUL SYUKRI BIN MD ZIN

B. ENG(HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

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_____

(Supervisor's Signature)

Full Name : DR. AMIZATULHANI BINTI ABDULLAH

Position :

Date :

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : MOHAMMAD AMIRUL SYUKRI BIN MD ZIN

ID Number : AA14113

Date : 12 JUNE 2018

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MOHAMMAD AMIRUL SYUKRI BIN MD ZIN

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ABSTRAK

Kegagalan cerun adalah bahaya geoteknikal yang serius di banyak negara di dunia termasuk Malaysia. Kegagalan cerun adalah satu fenomena dimana cerun runtuh secara tiba-tiba akibat lemahnya daya tahan diri bumi di bawah pengaruh hujan atau gempa bumi. Untuk projek ini, kestabilan cerun akan dikaji untuk mencegah kegagalan cerun berlaku. Langkah pencegahan perlu diambil untuk mengelakkan kemerosotan tanah daripada runtuh atau gagal. Untuk kajian ini, jenis dinding penahan gabion akan digunakan. Dinding gabion adalah tembok penahan yang terbuat dari batu yang disusun dan diikat bersama dengan dawai. Dinding Gabion biasanya bersudut ke arah cerun, atau disusun secara bertangga, dan bukan disusun secara menegak. Batu atau kerikil diklasifikasikan sebagai sumber yang tidak boleh diperbaharui yang akan terhad pada suatu masa akan datang pada masa akan datang. Untuk kajian ini, bukannya hanya batu, tetapi campuran batu dan serpihan tayar akan digunakan untuk mengisi dinding gabion. Model eksperimen dibangunkan untuk mensimulasikan tingkah laku cerun di bawah pengaruh hujan dengan sudut kritikal 60º. Berdasarkan analisis, dapat disimpulkan bahawa serpihan tayar adalah efektif sebagai bahan alternatif untuk dinding gabion bagi memastikan kestabilan cerun di bawah skala kecil.

ABSTRACT

Slope failure is a serious geotechnical hazard in many countries in the world including Malaysia. Slope failure is a phenomenon that a slope collapses abruptly due to weakened self-retainability of the earth under the influence of a rainfall or an earthquake. For this project, slope stability will be studied to prevent slope failure from happened. Preventive measure should be taken in order to prevent slope from collapse or fail. For this study, gabion types of retaining wall will be used. A gabion wall is a retaining wall made of stacked stone-filled gabions tied together with wire. Gabion walls are usually angled back towards the slope, or stepped back with the slope, rather than stacked vertically. Stones or gravel is classified as non-renewable resources which will be limited someday in the future. For this study, instead of gravel only, a mixture of tyre chips and stones will be use to fill the gabion wall. An experimental model is developed to simulate the behaviour of the slope under the influence of rainfall with a critical angle of 60º. Based on result analysis, it can be concluded that tyre chips is effective as alternate material for gabion wall to ensure slope stability under small scale.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Slope failure is a serious geotechnical hazard in many countries in the world including Malaysia. Slope failure is a phenomenon that a slope collapses abruptly due to weakened self-retainability of the earth under the influence of a rainfall or an earthquake. Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses. Material is constantly moving downslope in response to gravity. Movement can be very, very slow, barely perceptible over many years or movement can be devastatingly rapid, apparent within minutes. Whether or not slope movement occurs depends on slope steepness and slope stability. For this project, slope stability will be studied to prevent slope failure from happened. Slope stability is the potential of soil covered slopes to withstand and undergo movement. Slope stability is based on the interplay between two types of forces, driving forces and resisting forces. Driving forces promote downslope movement of material, whereas resisting forces deter movement. So, when driving forces overcome resisting forces, the slope is unstable and results in slope failure. Preventive measure should be taken in order to prevent slope from collapse or fail. For this study, gabion types of retaining wall will be used. Gabion by definition is a cage filled with rocks, concrete, or sometimes sand and soil. A gabion wall is a retaining wall made of stacked stone-filled gabions tied together with wire. Gabion walls are usually angled back towards the slope, or stepped back with the slope, rather than stacked vertically. For this study, instead of stones only, a mixture of tyre chips and stones will be use to fill the gabion wall.

1.2 Problem Statement

In Malaysia, slope failure tragedy had happened so many times before and had caused so many death tragedies, injuries and property damages. As example, the biggest slope failure tragedy happened in 11 December 1993 at Taman Hillview, Ulu Klang,

Selangor. The slope failed after prolong rainfall for about 2 weeks and had destroyed 3 blocks of apartment and 48 fatalities. Slope failure also cause a major money spending for the cost of repairing the damages and reparation for the victims.

Nowadays, almost all people in the world own vehicles which used tyres to move. Life expectancy for tyres is almost 2 or 3 years and need to be changed to a new one afterwards. Up to this century, stockpiling of used tyres have been a problem to the environment. The used tyres cannot be bury as tyres are difficult to compact and do not decompose easily. Not only do tyres take up valuable landfill space, but over time they tend to float to the top, working their way up through the waste and soil. Once they break through the surface, the landfill's cover is broken, exposing its contents to insects, rodents, and birds and allowing landfill gases to escape. Besides that, if the tyre is burned or happened to catch a fire, the fires are extremely dangerous and the most difficult problem associated with stockpiled waste tires. These fires are difficult to extinguish as the materials that make tyres good fuel unfortunately also makes tyre fires difficult to put out. Large tyre fires can burn for a long time, depleting firefighting resources. It will also cause air pollution as the hazardous compounds and potentially toxic gases are released in the thick black smoke produced by tire fires. It will also contaminate the ground as the oil and ash created during fires can contaminate the ground, endangering the ground and surface waters, In order to reduce the stockpiling of used tyres, this study proposed the use the tyres as one of the materials in the gabion wall and the effectiveness are studied.

Stones or gravel is classified as non-renewable resources which will be limited someday in the future. As a preventive measure, this study will propose to reduce the use of stones/gravel in the gabion wall. The effectiveness of this method also are studied.

1.3 Objectives of Study

There are two (2) objectives for this study:

- To determine the basic properties of tyre chips and soil used in the study.

- To determine the effectiveness of tyre chips and gravel mixture as material in gabion wall to stabilize slope

1.4 Scope of Study

For this project, several types of laboratory tests were conducted to determine the basic properties of the soil. The types of laboratory test that were conducted include sieve analysis, particle density test for sand, specific gravity test for gravel and tyre chips, standard proctor test and constant head permeability test.

An experimental model was also developed to study the behaviour and movement of the slope under the influence of rainfall.

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